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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/928,523	08/13/2001	Tomohiko Shibata	782_181	8032

25191 7590 06/15/2004

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EXAMINER	
SONG, MATTHEW J	
ART UNIT	**PAPER NUMBER**
1765	

DATE MAILED: 06/15/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/928,523	SHIBATA ET AL.
	Examiner	Art Unit
	Matthew J Song	1765

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 April 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *8-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *8-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *4/6/2004*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 4/6/2004 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 8-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vaudo et al (US 6,533,874) in view of Razeghi (US 5,599,732) and Dentai et al (US 4,830,982) and further in view of Mayeda (US 5,614,249) or Kim et al (US 5,728,940).

Vaudo et al discloses an apparatus for growing a (Ga,Al,In) nitride on a substrate using Hydride vapor phase epitaxy (HVPE) (Abstract). Vaudo et al discloses the HVPE reactor **52** is provided with feed ports **72, 74, 76** and **78**, HCl is introduced to the reactor in feed ports **72, 76'**, and **78'** (col 10, ln 1-67) and a substrate **56**. Vaudo et al also teaches feed port **74** accommodates the introduction of ammonia or other nitrogen species into the reactor in the direction and a vessel **67** of molten aluminum is provided in gas flow communication with feed port **76** (col 11, ln 1-40). Vaudo et al also teaches the growth of Al-containing nitride compounds such as AlN and AlGaN is complicated and to circumvent problems the entire growth reactor and or reactor liner which are employed should be constructed of alternative high temperature compatible materials, such as sapphire or graphite (col 11, ln 40-67). Vaudo et al also discloses a multi-zoned hot-wall reactor, where the temperature of the molten metals is independently controlled and temperatures of 1000-1400°C are employed (col 12, ln 1-15). Vaudo et al discloses aluminum chloride is transported to a deposition zone, this reads on applicant's downstream zone, where it reacts with ammonia to from AlN (col 11, ln 15-25). Vaudo et al discloses a vessel **67**, this reads on applicant's material holder and upstream zone, and a substrate holder **60**

Vaudo et al does not teach an inner reactor and outer reactor being spaced from one another.

In an apparatus for vapor phase growth of a III-V based material, note entire reference, Dentai et al teaches a fused silica reactor liner **5** which is spaced from the fused silica reactor **12**

(Fig 1). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify vaudo et al with Dentai et al's reactor liner spaced from the reactor because reactor liners improve reactor cleanliness and/or usable lifetime of reactors.

The combination of Vaudo et al and Dentai et al teaches the reactor should be made of high temperature compatible materials, such as sapphire or graphite. The combination of Vaudo et al and Dentai et al does not teach the reactor is made of aluminum nitride.

In a method of using a coated reactor for growing III-V semiconductor films, note entire reference, Razeghi teaches all surface of a growth reaction chamber is coated with a barrier coating capable of withstanding high temperatures and not reacting with reactants and dopants utilized at high temperatures and the coating is AlN (col 1, ln 55 to col 2, ln 10). Razeghi also teaches a quartz reaction tube (col 2, ln 20-25) and the AlN coating is deposited using metallo-organic chemical vapor deposition (MOCVD) (col 3, ln 50-67). Razeghi also teaches a stable barrier layer or buffer layer of AlN is formed that passivates the growth environment and prevents any oxygen impurities from reacting in the following deposition (col 3, ln 1-30). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Vaudo et al and Dentai et al with Razeghi's AlN coated quartz reactor because AlN is capable of withstanding high temperatures and not reacting with reactants and dopants utilized at high temperatures and AlN prevents oxygen and other impurities from reacting with a growing semiconductor layer (col 1, ln 65 to col 2, ln 5).

The combination of Vaudo et al, Dentai et al and Razeghi does not teach a gas leak detecting means.

In an apparatus for detecting a leak in a chemical vapor deposition, note entire reference, Mayeda teaches a deposition apparatus with a plurality of access channels for a test gas, which allows specific leak testing at selected points in the apparatus (col 2, ln 20-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Vaudo et al, Dentai et al and Razeghi with Mayeda's leak detection system to prevent damage ('249 col 1, ln 45-67).

In an apparatus for detects leaks in a semiconductor device, note entire reference, Kim et al teaches a leakage gas detector **11** installed in the semiconductor manufacturing device for detecting the leakage of a reaction gas used in a semiconductor device manufacturing process (col 1, ln 1-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Vaudo et al, Dentai et al and Razeghi with Kim et al's leakage detector to increase the lifespan of the apparatus and prevent explosions (col 1, ln 15-30).

Referring to claims 9-11, the combination of Vaudo et al, Dentai et al Razeghi and Kim et al or the combination of Vaudo et al, Dentai et al, Razeghi and Mayeda et al teach all of the structural limitations of claims 9-11. Claims 9-11 also contain method limitations, which are considered intended use and the apparatus taught by the combination of Vaudo et al, Dentai et al, Razeghi and Kim et al or the combination of Vaudo et al, Dentai et al, Razeghi and Mayeda et al would inherently be capable of performing the claimed intended use of the apparatus.

4. Claims 8-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vaudo et al (US 6,533,874) in view of Razeghi (US 5,599,732) and Yoshida et al (JP 2-34592), an English

Translation has been provided, and further in view of Mayeda (US 5,614,249) or Kim et al (US 5,728,940).

Vaudo et al discloses an apparatus for growing a (Ga,Al,In) nitride on a substrate using Hydride vapor phase epitaxy (HVPE) (Abstract). Vaudo et al discloses the HVPE reactor **52** is provided with feed ports **72, 74, 76** and **78**, HCl is introduced to the reactor in feed ports **72**, **76'**, and **78'** (col 10, ln 1-67) and a substrate **56**. Vaudo et al also teaches feed port **74** accommodates the introduction of ammonia or other nitrogen species into the reactor in the direction and a vessel **67** of molten aluminum is provided in gas flow communication with feed port **76** (col 11, ln 1-40). Vaudo et al also teaches the growth of Al-containing nitride compounds such as AlN and AlGaN is complicated and to circumvent problems the entire growth reactor and or reactor liner which are employed should be constructed of alternative high temperature compatible materials, such as sapphire or graphite (col 11, ln 40-67). Vaudo et al also discloses a multi-zoned hot-wall reactor, where the temperature of the molten metals is independently controlled and temperatures of 1000-1400°C are employed (col 12, ln 1-15). Vaudo et al discloses aluminum chloride is transported to a deposition zone, this reads on applicant's downstream zone, where it reacts with ammonia to from AlN (col 11, ln 15-25). Vaudo et al discloses a vessel **67**, this reads on applicant's material holder and upstream zone, and a substrate holder **60**

Vaudo et al does not teach an inner reactor and outer reactor being spaced from one another.

In an apparatus for forming single crystals, Yoshida et al teaches a quartz liner **18** spaced apart from a quartz amouple **11**, this reads on applicant's inner and outer reactor being spaced from one another (Translation pg 5 and Figs 1 and 2). It would have been obvious to a person of

ordinary skill in the art at the time of the invention to modify Vaudo et al with Yoshida et al's quartz liner because a liner tube between a reactor and a heater ensures uniform heating of the reactor.

The combination of Vaudo et al and Yoshida et al teaches the reactor should be made of high temperature compatible materials, such as sapphire or graphite. The combination of Vaudo et al and Yoshida et al does not teach the reactor is made of aluminum nitride.

In a method of using a coated reactor for growing III-V semiconductor films, note entire reference, Razeghi teaches all surface of a growth reaction chamber is coated with a barrier coating capable of withstanding high temperatures and not reacting with reactants and dopants utilized at high temperatures and the coating is AlN (col 1, ln 55 to col 2, ln 10). Razeghi also teaches a quartz reaction tube (col 2, ln 20-25) and the AlN coating is deposited using metallo-organic chemical vapor deposition (MOCVD) (col 3, ln 50-67). Razeghi also teaches a stable barrier layer or buffer layer of AlN is formed that passivates the growth environment and prevents any oxygen impurities from reacting in the following deposition (col 3, ln 1-30). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Vaudo et al and Yoshida et al with Razeghi's AlN coated quartz reactor because AlN is capable of withstanding high temperatures and not reacting with reactants and dopants utilized at high temperatures and AlN prevents oxygen and other impurities from reacting with a growing semiconductor layer (col 1, ln 65 to col 2, ln 5).

The combination of Vaudo et al, Yoshida et al and Razeghi does not teach a gas leak detecting means.

In an apparatus for detecting a leak in a chemical vapor deposition, note entire reference, Mayeda teaches a deposition apparatus with a plurality of access channels for a test gas, which allows specific leak testing at selected points in the apparatus (col 2, ln 20-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Vaudo et al, Yoshida et al and Razeghi with Mayeda's leak detection system to prevent damage ('249 col 1, ln 45-67).

In an apparatus for detects leaks in a semiconductor device, note entire reference, Kim et al teaches a leakage gas detector **11** installed in the semiconductor manufacturing device for detecting the leakage of a reaction gas used in a semiconductor device manufacturing process (col 1, ln 1-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Vaudo et al, Yoshida et al and Razeghi with Kim et al's leakage detector to increase the lifespan of the apparatus and prevent explosions (col 1, ln 15-30).

Referring to claims 9-11, the combination of Vaudo et al, Yoshida et al Razeghi and Kim et al or the combination of Vaudo et al, Yoshida et al, Razeghi and Mayeda et al teach all of the structural limitations of claims 9-11. Claims 9-11 also contain method limitations, which are considered intended use and the apparatus taught by the combination of Vaudo et al, Yoshida et al, Razeghi and Kim et al or the combination of Vaudo et al, Yoshida et al, Razeghi and Mayeda et al would inherently be capable of performing the claimed intended use of the apparatus.

5. Claims 8-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vaudo et al (US 6,533,874) in view of Razeghi (US 5,599,732) and Nakamura (US 5,334,277) and further in view of Mayeda (US 5,614,249) or Kim et al (US 5,728,940).

Vaudo et al discloses an apparatus for growing a (Ga,Al,In) nitride on a substrate using Hydride vapor phase epitaxy (HVPE) (Abstract). Vaudo et al discloses the HVPE reactor **52** is provided with feed ports **72, 74, 76** and **78**, HCl is introduced to the reactor in feed ports **72, 76'**, and **78'** (col 10, ln 1-67) and a substrate **56**. Vaudo et al also teaches feed port **74** accommodates the introduction of ammonia or other nitrogen species into the reactor in the direction and a vessel **67** of molten aluminum is provided in gas flow communication with feed port **76** (col 11, ln 1-40). Vaudo et al also teaches the growth of Al-containing nitride compounds such as AlN and AlGaN is complicated and to circumvent problems the entire growth reactor and or reactor liner which are employed should be constructed of alternative high temperature compatible materials, such as sapphire or graphite (col 11, ln 40-67). Vaudo et al also discloses a multi-zoned hot-wall reactor, where the temperature of the molten metals is independently controlled and temperatures of 1000-1400°C are employed (col 12, ln 1-15). Vaudo et al discloses aluminum chloride is transported to a deposition zone, this reads on applicant's downstream zone, where it reacts with ammonia to from AlN (col 11, ln 15-25). Vaudo et al discloses a vessel **67**, this reads on applicant's material holder and upstream zone, and a substrate holder **60**

Vaudo et al does not teach an inner reactor and outer reactor being spaced from one another.

In an apparatus for vapor growing semiconductors, note entire reference, Nakamura teaches a reactor vessel has a double cylinder structure using quartz tubes, which are spaced from

one another and an induction coil **12** for heating a substrate **18** (Fig 5 and col 2, ln 60 to col 3, ln 40). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Vaudo et al with Nakamura's reactor vessel because a liner tube between a reactor and a heater ensures uniform heating.

The combination of Vaudo et al and Nakamura teaches the reactor should be made of high temperature compatible materials, such as sapphire or graphite. The combination of Vaudo et al and Nakamura does not teach the reactor is made of aluminum nitride.

In a method of using a coated reactor for growing III-V semiconductor films, note entire reference, Razeghi teaches all surface of a growth reaction chamber is coated with a barrier coating capable of withstanding high temperatures and not reacting with reactants and dopants utilized at high temperatures and the coating is AlN (col 1, ln 55 to col 2, ln 10). Razeghi also teaches a quartz reaction tube (col 2, ln 20-25) and the AlN coating is deposited using metallo-organic chemical vapor deposition (MOCVD) (col 3, ln 50-67). Razeghi also teaches a stable barrier layer or buffer layer of AlN is formed that passivates the growth environment and prevents any oxygen impurities from reacting in the following deposition (col 3, ln 1-30). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Vaudo et al and Nakamura with Razeghi's AlN coated quartz reactor because AlN is capable of withstanding high temperatures and not reacting with reactants and dopants utilized at high temperatures and AlN prevents oxygen and other impurities from reacting with a growing semiconductor layer (col 1, ln 65 to col 2, ln 5).

The combination of Vaudo et al, Nakamura and Razeghi does not teach a gas leak detecting means.

In an apparatus for detecting a leak in a chemical vapor deposition, note entire reference, Mayeda teaches a deposition apparatus with a plurality of access channels for a test gas, which allows specific leak testing at selected points in the apparatus (col 2, ln 20-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Vaudo et al, Nakamura and Razeghi with Mayeda's leak detection system to prevent damage ('249 col 1, ln 45-67).

In an apparatus for detects leaks in a semiconductor device, note entire reference, Kim et al teaches a leakage gas detector **11** installed in the semiconductor manufacturing device for detecting the leakage of a reaction gas used in a semiconductor device manufacturing process (col 1, ln 1-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Vaudo et al, Nakamura and Razeghi with Kim et al's leakage detector to increase the lifespan of the apparatus and prevent explosions (col 1, ln 15-30).

Referring to claims 9-11, the combination of Vaudo et al, Nakamura, Razeghi and Kim et al or the combination of Vaudo et al, Nakamura, Razeghi and Mayeda et al teach all of the structural limitations of claims 9-11. Claims 9-11 also contain method limitations, which are considered intended use and the apparatus taught by the combination of Vaudo et al, Nakamura, Razeghi and Kim et al or the combination of Vaudo et al, Nakamura, Razeghi and Mayeda et al would inherently be capable of performing the claimed intended use of the apparatus.

Response to Arguments

6. Applicant's arguments with respect to claims 8-11 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Kang et al (US 6,197,683) teaches a metal source gas is mixed with a carrier gas such as Ar or N_2 to provide a smooth flow into a deposition chamber (col 6, ln 5-35).

Usui et al (JP 2000-91234) teaches HCl is supplied from an introducing pipe with a carrier gas in a HVPE process (Abstract).

Radhakrishnan (US 5,650,361) teaches an AlN chamber used for the deposition of AlN films (col 4, ln 1-15 and Abstract).

Razeghi et al (US 6,271,104) teaches all surface of a growth reaction chamber are coated with a barrier coating capable of withstanding high temperatures and not reacting with the reactants and the coating is preferably AlN (col 3, ln 15-50).

Molnar (US 6,086,673) teaches a HVPE apparatus, note Fig 1.

Ueda et al (US 6,117,213) teaches a HVPE apparatus using to form AlN (col 3).

Vaudo et al (US 6,596,079) teaches reactor liner can be used and replaced to improve reactor cleanliness and/or usable lifetime (col 11, ln 35-50).

Kawase et al (US 4,382,776) teaches a liner tube must be provided in the gap between a processing tube and a heater, so as to ensure uniform heating of the tube (col 1, ln 5-65).

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song
Examiner
Art Unit 1765

MJS

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER